XXX. *An Account of the* Bramin's *Obſervatory at* Benares. *By Sir* Robert Barker, *Knt. F. R. S.*; *in a Letter to Sir* John Pringle, *Bart. P. R. S.*

SIR,

Read May 29, 1777.

BENARES in the Eaſt Indies, one of the principal ſeminaries of the Bramins or prieſts of the original Gentoos of Hindoſtan, continues ſtill to be the place of reſort of that ſect of people; and there are many publick charities, hoſpitals, and pagodas, where ſome thouſands of them now reſide. Having frequently heard that the ancient Bramins had a knowledge of aſtronomy, and being confirmed in this by their information of an approaching eclipſe both of the Sun and Moon, I made inquiry, when at that place in the year 1772, among the principal Bramins, to endeavour to get ſome information relative to the manner in which they were acquainted of an approaching eclipſe. The moſt intelligent that I could meet with, however, gave me but little ſatisfaction. I was told, that theſe matters were confined to a few, who were in poſſeſſion of certain books and records; ſome containing the myſteries of their religion, and others the tables of aſtronomical obſervations, written in the Skanſkirrit language, which few underſtood but themſelves: that they would take me to a place which had been conſtructed for the purpoſe of making ſuch obſervations as I was inquiring after, and from whence they ſuppoſed the learned Bramins made theirs. I was then conducted to an ancient building of ſtone, the lower part of which, in its preſent ſituation, was converted into a ſtable for horſes, and a receptacle for lumber; but, by the number of court-yards and apartments, it appeared that it muſt once have been an edifice for the uſe of ſome public body of people. We entered this building, and went up a ſtair-caſe to the top of a part of it, near to the river Ganges, that led to a large terrace, where, to my ſurprize and ſatisfaction, I ſaw a number of inſtruments yet remaining, in the greateſt preſervation, ſtupendouſly large, immoveable from the ſpot, and built of ſtone, ſome of them being upwards of twenty feet in height; and, although they are ſaid to have been erected two hundred years ago, the graduations and diviſions on the ſeveral arcs appeared as well cut, and as accurately divided, as if they had been the performance of a modern artiſt. The execution in the conſtruction of theſe inſtruments exhibited a mathematical exactneſs in the fixing, bearing, and fitting of the ſeveral parts, in the neceſſary and ſufficient ſupports to the very large ſtones that compoſed them, and in the joining and faſtening each into the other by means of lead and iron.

The ſituation of the two large quadrants of the inſtrument marked A in the firſt plate, whoſe radius is nine feet two inches, by their being at right angles with a gnomon at twenty-five degrees elevation, are thrown into ſuch an oblique ſituation as to render them the moſt difficult, not only to conſtruct of ſuch a magnitude, but to ſecure in their poſition for ſo long a period, and affords a ſtriking inſtance of the ability of the architect in their conſtruction; for, by the ſhadow of the gnomon thrown on the quadrants, they do not appear to have altered in the leaſt from their original poſition; and ſo true is the line of the gnomon, that, by applying the eye to a ſmall iron ring of an inch diameter at one end, the ſight is carried through three others of the ſame dimenſion to the extremity at the other end, diſtant thirty-eight feet eight inches, without obſtruction; ſuch is the firmneſs and art with which this inſtrument has been executed. This performance is the more wonderful and extraordinary when compared with the works of the artificers of Hindoſtan at this day, who are not under the immediate direction of an European mechanic; but arts appear to have declined equally with ſcience in the Eaſt.

Lieutenant-colonel ARCHIBALD CAMPBELL, at that time chief engineer in the Eaſt India Company's ſervice at Bengal, a gentleman whoſe abilities do honour to his profeſſion, made a perſpective drawing of the whole of the apparatus that could be brought within his eye at one view; but I lament he could not repreſent ſome very large quadrants, whoſe radii were about twenty feet, they being on the ſide from whence he took his drawing. Their deſcription however is, that they are exact quarters of circles of different radii, the largeſt of which I judged to be twenty feet, conſtructed very exactly on the ſides of ſtone walls built perpendicular, and ſituated, I ſuppoſe, in the meridian of the place: a braſs pin is fixed at the center or angle of the quadrant, from whence, the Bramin informed me, they ſtretched a wire to the circumference when an obſervation was to be made; from which it occurred to me, the obſerver muſt have moved his eye up or down the circumference, by means of a ladder or ſome ſuch contrivance, to raiſe and lower himſelf, until he had diſcovered the altitude of any of the heavenly bodies in their paſſage over the meridian, ſo expreſſed on the arcs of theſe quadrants: theſe arcs were very exactly divided into nine large ſections; each of which again into ten, making ninety leſſer diviſions or degrees; and thoſe alſo into twenty, expreſſing three minutes each, of about two-tenths of an inch aſunder; ſo that it is probable, they had ſome method of dividing even theſe into more minute diviſions at the time of obſervation.

My time would only permit me to take down the particular dimenſions of the moſt capital inſtrument, or the greater equinoctial Sun-dial, repreſented by figure A, plate 12. which appears to be an inſtrument to expreſs ſolar time by the ſhadow of a gnomon upon two quadrants, one ſituated to the eaſt, and the other to the weſt of it; and indeed the chief part of their inſtruments at this place appear to be conſtructed for the ſame purpoſe, except the quadrants, and a braſs inſtrument that will be deſcribed hereafter.

Figure B is another inſtrument for the purpoſe of determining the exact hour of the day by the ſhadow of a gnomon, which ſtands perpendicular to and in the center of a flat circular ſtone, ſupported in an oblique ſituation by means of four upright ſtones and a croſs-piece; ſo that the ſhadow of the gnomon, which is a perpendicular iron rod, is thrown upon the diviſions of the circle deſcribed on the face of the flat, circular ſtone.

Figure c is a braſs circle, about two feet diameter, moving vertically upon two pivots between two ſtone pillars, having an index or hand turning round horizontally on the center of this circle, which is divided into 360 parts; but there are no counter diviſions on the index to ſub-divide thoſe on the circle. This inſtrument appears to be made for taking the angle of a ſtar at ſetting or riſing, or for taking the azimuth or amplitude of the Sun at riſing or ſetting.

The uſe of the inſtrument, figure D, I was at a loſs to account for. It conſiſts of two circular walls; the outer of which is about forty feet diameter, and eight feet high; the wall within about half that height, and appears intended for a place to ſtand on to obſerve the diviſions on the upper circle of the outer wall, rather than for any other purpoſe; and yet both circles are divided into 360 degrees, each degree being ſub-divided into twenty leſſer diviſions, the ſame as the quadrants. There is a door-way to paſs into the inner circle, and a pillar in the center, of the ſame height with the lower circle, having a hole in it, being the center of both circles, and ſeems to be a ſocket for an iron rod to be placed perpendicular into it. The diviſions on theſe, as well as all the other inſtruments, will bear a nice examination with a pair of compaſſes.

Figure E is a ſmaller equinoctial Sun-dial, conſtructed upon the ſame principle as the large one A.

I cannot quit this ſubject without obſerving, that the Bramins, without the aſſiſtance of optical glaſſes, had nevertheleſs an advantage unexperienced by the obſervers of the more Northern climates. The ſerenity and clearneſs of the atmoſphere in the night-time in the Eaſt Indies, except at the ſeaſons of changing the monſoons or periodical winds, is difficult to expreſs to thoſe who have not ſeen it, becauſe we have nothing in compariſon to form our ideas upon: it is clear to perfection, a total quietude ſubſiſts, ſcarcely a cloud to be ſeen; and the light of the heavens, by the numerous appearance of the ſtars, affords a proſpect both of wonder and contemplation.

This obſervatory at Benares is ſaid to have been built by the order of the emperor ACKBAR; for as this wiſe prince endeavoured to improve the arts, ſo he wiſhed alſo to recover the ſciences of Hindoſtan, and therefore directed that three ſuch places ſhould be erected; one at Delhi, another at Agra, and the third at Benares.

Some doubts have ariſen with regard to the certainty of the ancient Bramins having a knowledge in aſtronomy, and whether the Perſians might not have introduced it into Hindoſtan when conquered by that people;

but theſe doubts I think muſt vaniſh, when we know that the preſent Bramins pronounce, from the records and tables which have been handed down to them by their forefathers, the approach of the eclipſes of the Sun and Moon, and regularly as they advance give timely information to the emperor and the princes in whoſe dominion they reſide. There are yet ſome remains in evidence of their being at one time in poſſeſſion of this ſcience. The ſigns of the zodiac, in ſome of their Choultrys on the coaſt of Coromandel, as remarked by JOHN CALL, eſq. F. R. S. in his letter to the Aſtronomer Royal, requires little other confirmation. Mr. CALL ſays, that as he was laying on his back, reſting himſelf in the heat of the day, in a Choultry at Verdapetah in the Madura country, near Cape Commorin, he diſcovered the ſigns of the zodiac on the cieling of the Choultry: that he found one, equally compleat, which was on the cieling of a temple, in the middle of a Tank before the pagoda Teppecolum near Mindurah; and that he had often met with ſeveral parts in detached pieces. See Philoſ. Tranſ. 1772, p. 353. Theſe buildings and temples were the places of reſidence and worſhip of the original Bramins, and bear the marks of great antiquity, having perhaps been built before the Perſian conqueſt. Beſides, when we know that the manners and cuſtoms of the Gentoo religion are ſuch as to preclude them from admitting the ſmalleſt innovation in their inſtitutions; when we alſo know that their faſhion in dreſs, and the mode of their living, have not received the leaſt variation from the earlieſt account we have of them; it cannot be ſuppoſed they would engrave the ſymbolical figures of the Perſian aſtronomy in their ſacred temples; the ſigns of the zodiac muſt therefore have originated with them, if we credit their tradition of the purity of their religion and cuſtoms.

Mr. FRASER, in his Hiſtory of the Mogul Emperors, ſpeaking of time ſays, "the Lunar year they reckon "354 days, 22 gurris, 1 pull; the Solar year they "reckon 365 days, 15 gurris, 30 pulls, $22\frac{1}{2}$ peels; 60 "peels making 1 pull, 60 pulls 1 gurri, and 60 gurris "1 day. This is according to the Bramins or Indian "prieſts, and what the Moguls and other Mahommedans in India chiefly go by."

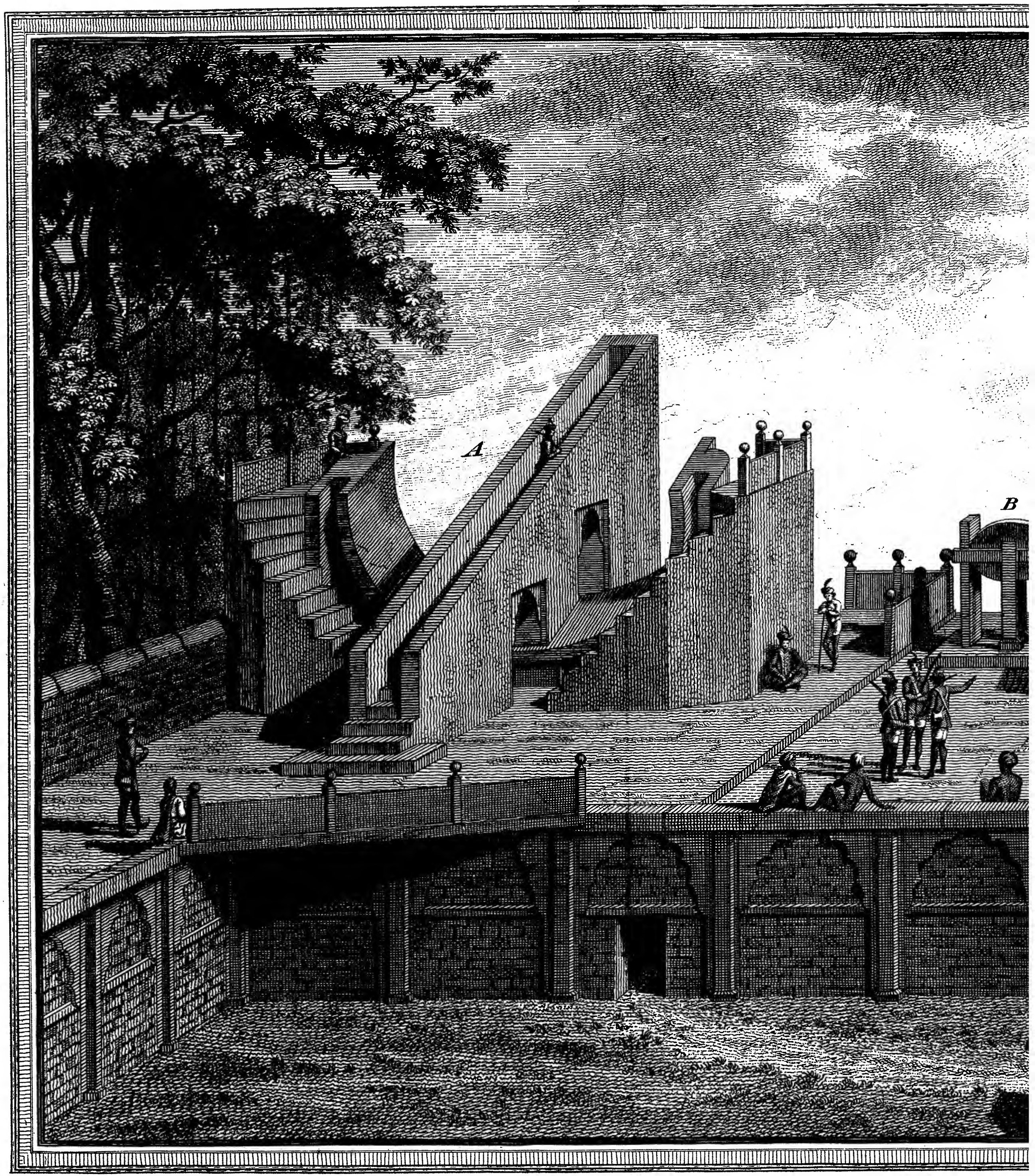
Thus far Mr. FRASER; and it ſerves to ſtrengthen the argument for ſuppoſing that the Bramins had a knowledge of aſtronomy before the introduction of Mahometaniſm into Hindoſtan.

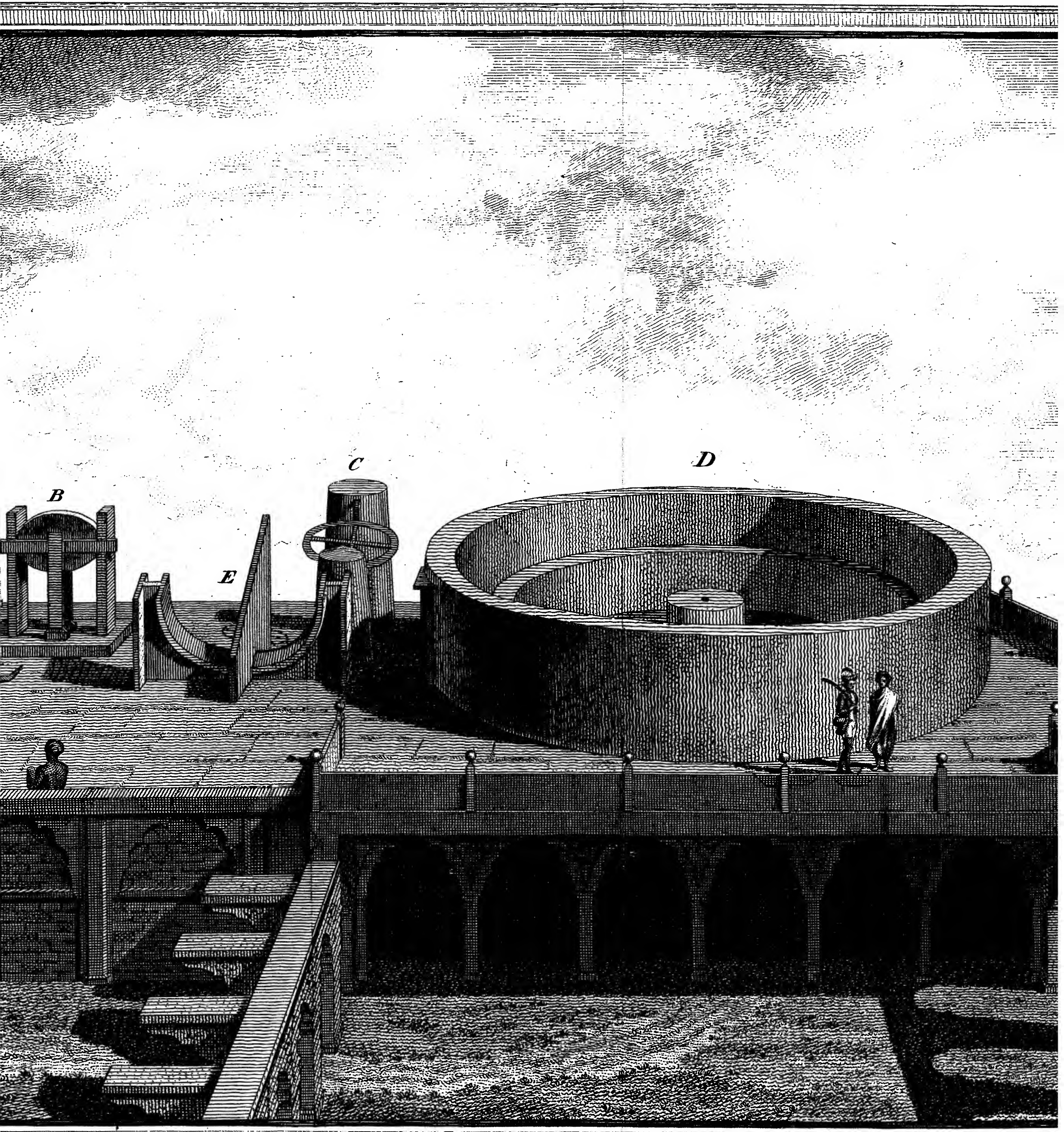
Dimenſions of the larger equinoctial Sun-dial, plates 13. and 14.

	Feet.	In.
Length of the gnomon at the baſe *b b*,	34	8
Oblique length of the gnomon *c c*, —	38	8
Radius of the quadrants *a a*, — —	9	2
Height of the gnomon at *d*, — —	22	3
Breadth of the quadrants *f f*, — —	5	10
Thickneſs *g g*, — —	1	0
Breadth of the gnomon *h h*, — —	4	6
Whole extent of the inſtrument *i i*, —	37	4

Latitude of the place taken by double altitude 25° 10.

I am, &c.


A
B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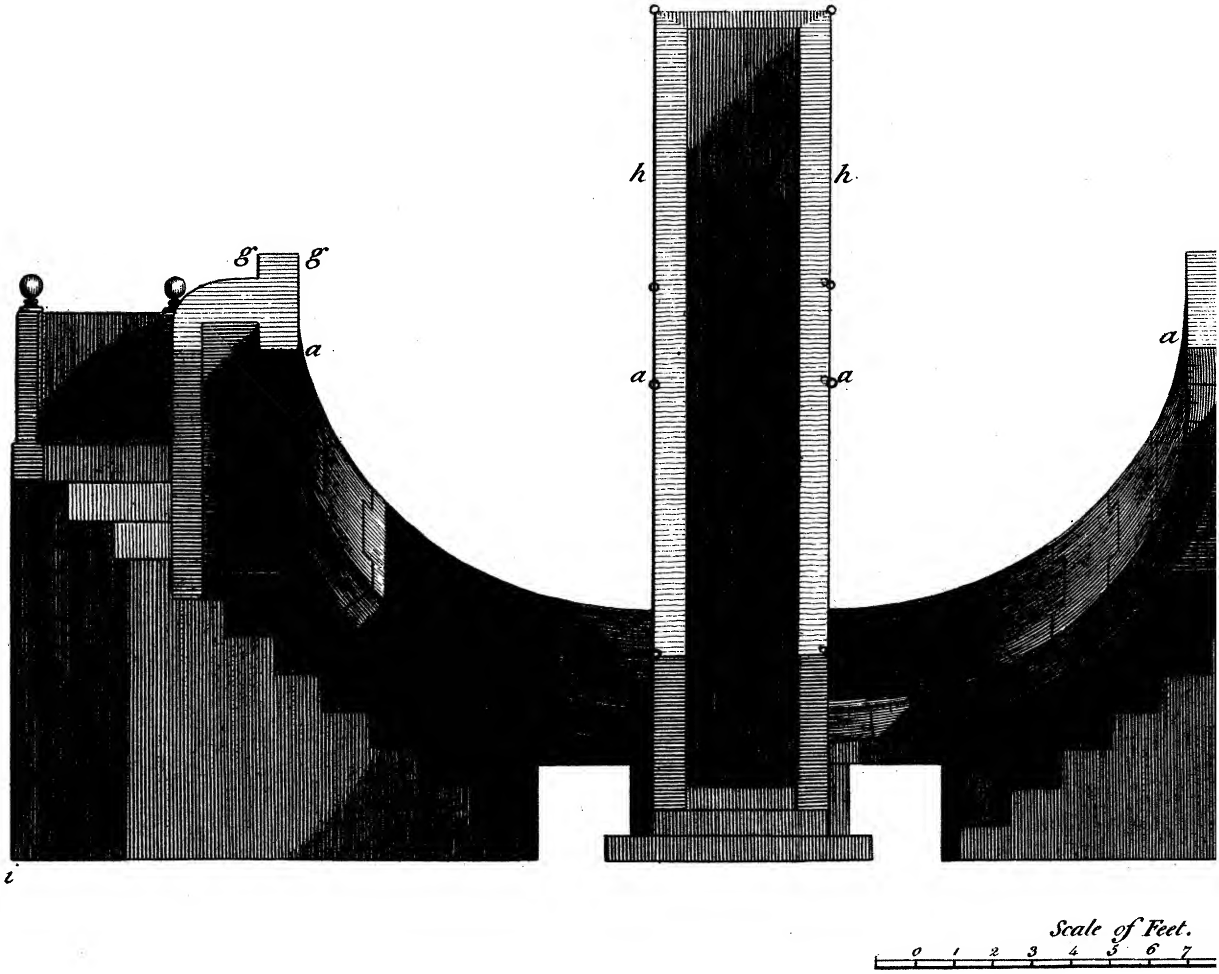
E

s.Trans. Vol. LXVII. Tab. XII. p. 608.

Basire sc.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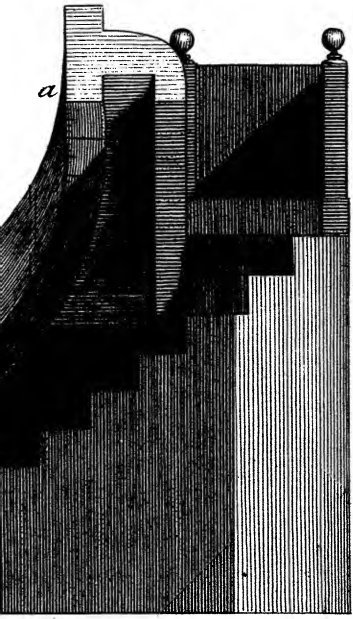

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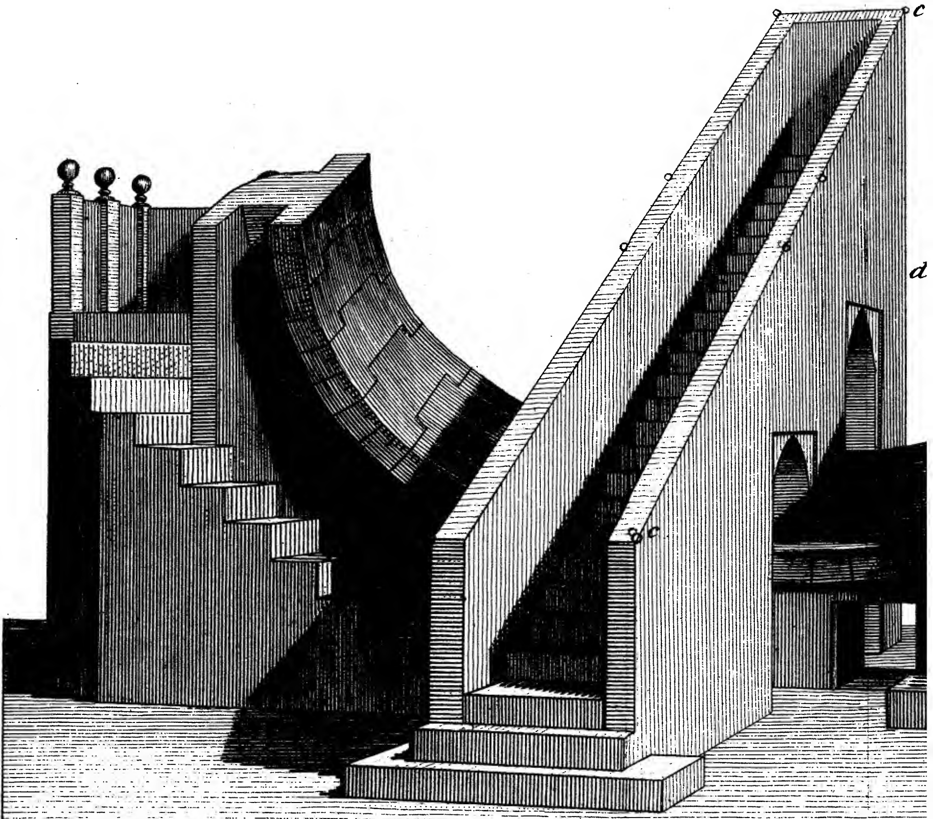

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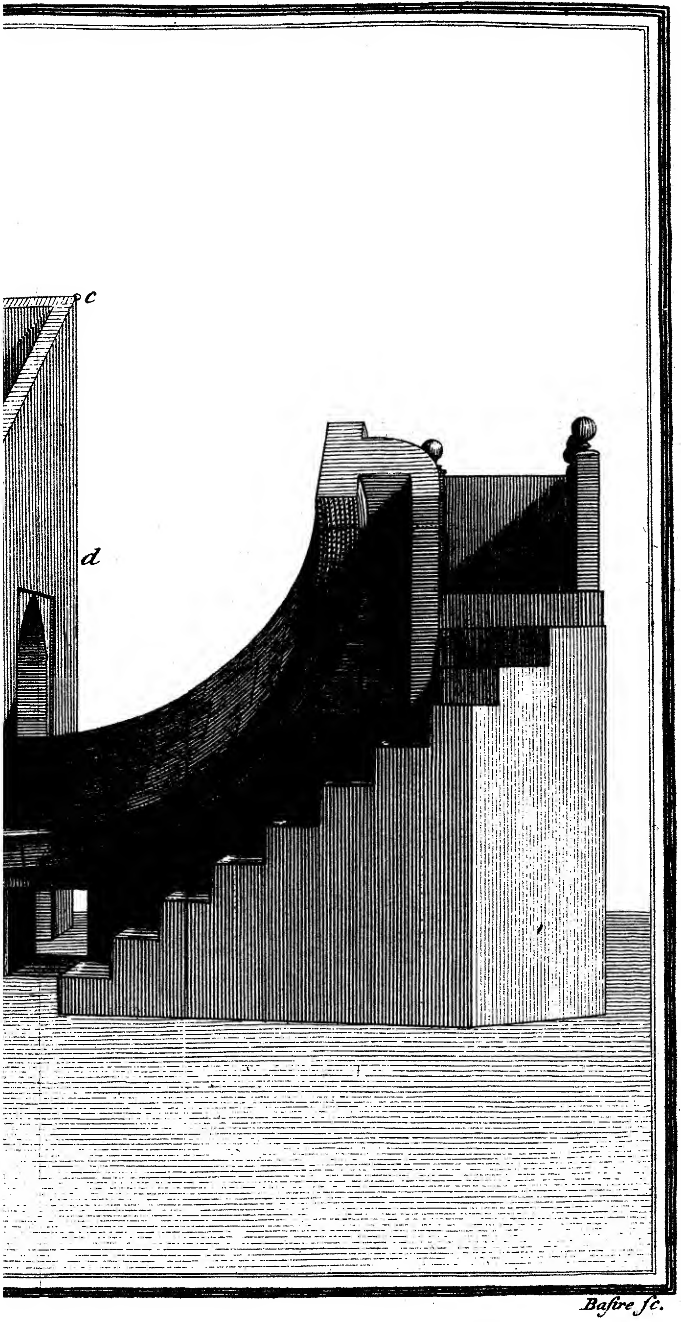

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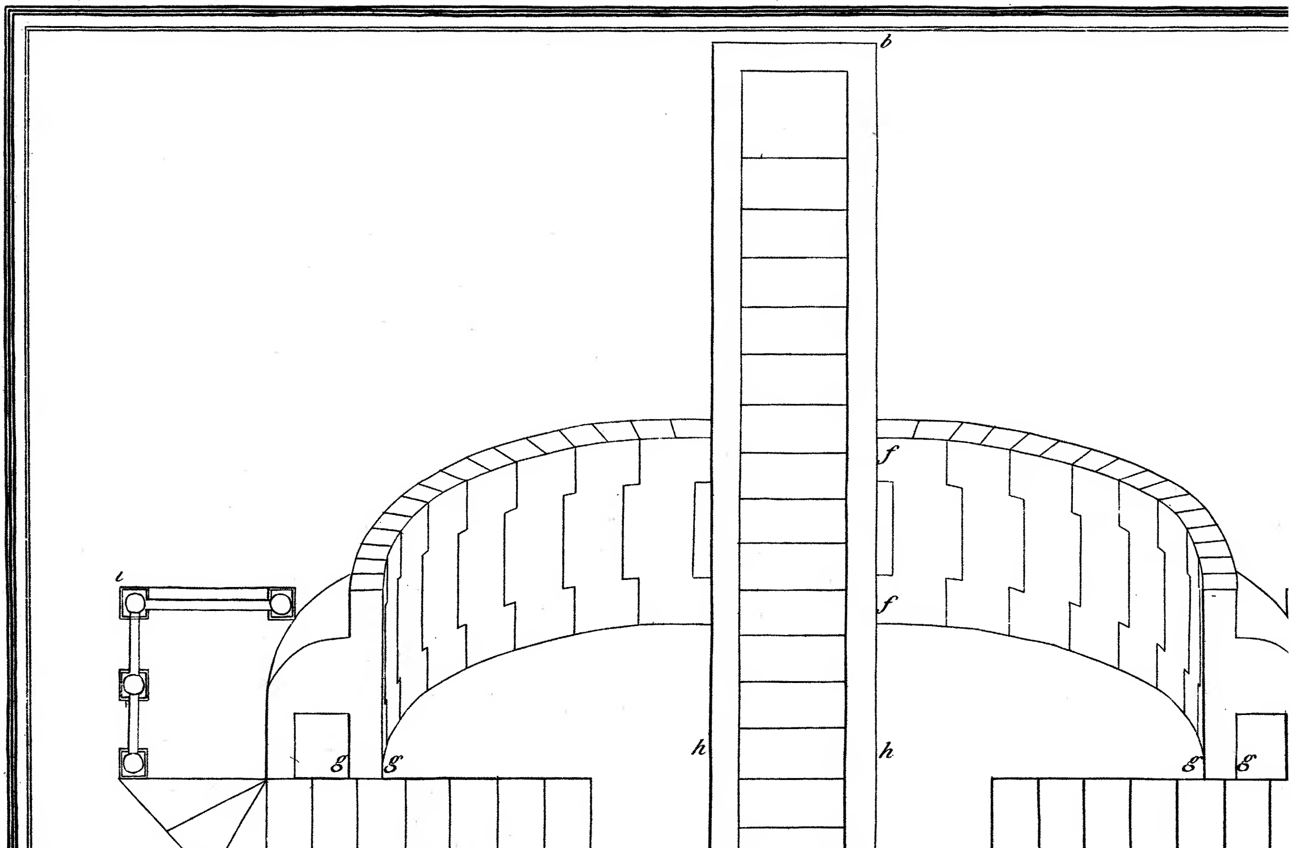
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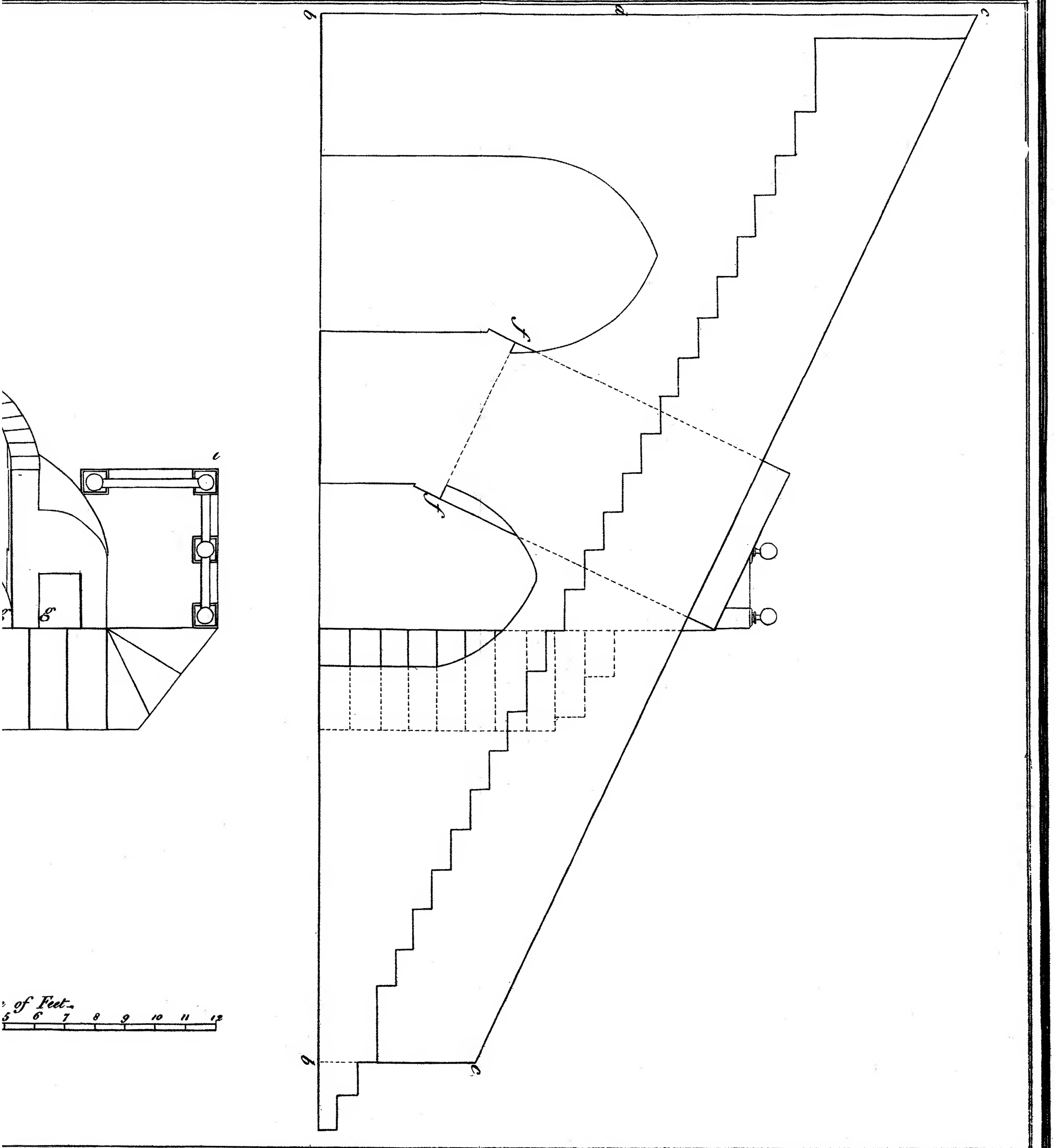

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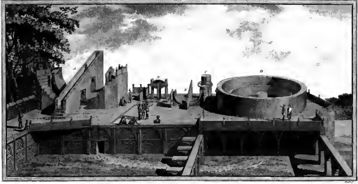

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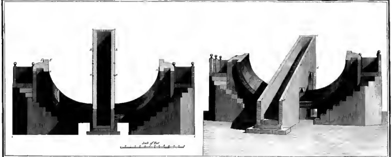
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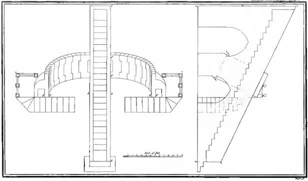
Scale of Feet
A
B